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PTO/SB/21 (02-04)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	09/823,839
Filing Date	March 30, 2001
First Named Inventor	PHATAK, Prashant
Art Unit	2822
Examiner Name	Guerrero, M.
Total Number of Pages in This Submission: 77	Attorney Docket Number: CY-0019

ENCLOSURES *(Check all that apply)*

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
- [ ] After Allowance communication to Technology Center (TC)
- [ ] Appeal Communication to Board of Appeals and Interferences
- [x] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [ ] Other Enclosure(s) (please Identify below):

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Bradley T. Sako WALKER & SAKO, LLP
Signature	
Date	June 29, 2004

CERTIFICATE OF TRANSMISSION/MAILING

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Signature		Date	6/29/2004

PTO/SB/17 (10-03)
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FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 330.00

Complete if Known	
Application Number	09/823,839
Filing Date	March 30, 2001
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Attorney Docket No.	CY-0019

METHOD OF PAYMENT *(check all that apply)*

☑ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☐ Deposit Account:

Deposit Account Number: 50-2087

Deposit Account Name: Walker & Sako, LLP

The Director is authorized to: *(check all that apply)*

☐ Charge fee(s) indicated below ☐ Credit any overpayments

☑ Charge any additional fee(s) or any underpayment of fee(s)

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FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	

SUBTOTAL (1) ($) 0

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

	Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =		X	=
Independent Claims		- 3** =		X	=
Multiple Dependent					=

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0

***or number previously paid, if greater; For Reissues, see above*

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	330.00
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,330	2453	665	Petition to revive - unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 330.00

SUBMITTED BY

(Complete *(if applicable)*)

Name *(Print/Type)*	Bradley T. Sako	Registration No. *(Attorney/Agent)*	37,923	Telephone	408.289.5315
Signature				Date	6/29/2004

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This collection of information is required by 37 CFR 1.17 and 1.27. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Attorney Docket: CY-0019

In re application of: **PHATAK et al.**

Serial No.: **09/823,839** Group No.: **2822**

Filed: **March 30, 2001** Examiner: **Guerrero, M.**

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPELLANT'S BRIEF

Timing of Appeal Brief and Fees Required Pursuant to 37 C.F.R. 1.192(a)(b)

This brief is in furtherance of the Notice of Appeal for this case filed on May 4, 2004 and is due July 5, 2004.

The fees required under 37 C.F.R. 1.17(c), and any fees for a petition for extension of time for filing this brief are dealt with in the accompanying Transmittal of Appeal Brief.

Certificate of Mailing/Transmission (37 C.F.R. 1.8(a))

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[X] deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to the Mail Stop Appeal Brief, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

[ ] transmitted by facsimile to the Patent and Trademark Office.

Date: **June 29, 2004** Signature: 

Typed/Printed Name: **Bradley T. Sako**

Appeal Brief Items Pursuant to 37 C.F.R. 1.192(c)

This brief contains the following items under the headings, and in the order set forth below.

1. Real Party in Interest
2. Related Appeals and Interferences
3. Status of Claims
4. Status of Amendments
5. Summary of Invention
6. Issues
7. Grouping of Claims
8. Argument
9. Appendix

1. Real Party in Interest

The patent application on appeal is owned by Cypress Semiconductor Corporation, a Delaware Corporation, having offices at 3901 North First Street, San Jose, CA 95134.

2. Related Appeals and Interferences

There are no other appeals or interferences related to, or that may be affected by a decision of the Board of Patent Appeals and Interferences (the Board) on this appeal.

3. Status of Claims

The status of all claims is set forth below:

Claims cancelled: 6 and 12-13.

Claims allowed: 17.

Claims rejected: Claims 1-5, 7-11, 14-16, and 18-19.

Claims withdrawn: 20-22.

The claims on appeal are claims 1-5, 7-11, 14-16, and 18-19.

4. Status of Amendments

As indicated by the Advisory Action, dated 04/13/04, the amendments submitted after the final rejection have been entered.

5. Summary of Invention

The invention of claim 1 is directed to a method that includes varying a dopant supply rate (e.g., FIG. 5, items **502** and **504**, and the Specification, Page 7, Lines 7-15; FIG. 6, right-most column titled "NEW PROCESS", and the Specification, Page 10, Lines 1-3) for a doped insulating layer (e.g., the Specification, Page 6, Line 20 to Page 7, Line 6 and Page 7, Lines 20-23; Page 8, Lines 16-19; FIG. 7, item **702** and the Specification Page 11, Lines 10-13) according to a variation in temperature of a substrate (e.g., FIG. 5, item **500**, and the Specification, Page 6, Lines 20-21 and Page 6, Line 23 to Page 7, Line 6; Page 9, Lines 16-18) on which the doped

insulating layer is being formed. In addition, according to the method varying the dopant supply rate includes increasing the dopant supply rate as the substrate temperature increases (e.g., FIG. 5, items **502/504** and **500**, and the Specification, Page 7, Lines 4-7; Page 9, Line 23 to Page 10, Line 3).

The invention of claim 3 includes the various limitations of claim 1, as well as those of intervening claim 2: varying the dopant supply rate includes providing different dopant supply rates for different time periods. Claim 3 then recites that the different time periods include a plurality of different time periods of the same length (e.g., the Specification, Page 7, Lines 12-14; FIG. 6, left-most column titled "STEP TIME" and the Specification, Page 9, Lines 20-21).

The invention of claim 11 is directed to method that includes compensating for a temperature dependent dopant gradient (see FIG. 1, item **100**, and the Specification, Page 4, Lines 4-7; Page 8, Lines 12-15; Page 9, Lines 18-21; Page 11, Lines 10-12) in a doped insulating film comprising silicon oxide having a phosphorous concentration greater than about 7% by weight (e.g., the Specification, Page 8, Line 21 to Page 9, Line 1; Page 9, Lines 14-16; Page 11, Lines 3-4), by varying a dopant supply rate as the doped insulating film is formed. According to the method, the dopant supply rate is varied for an initial thickness (e.g., the Specification, Page 10, Lines 5-10 and 16-19) of the doped insulating film to compensate for variations in a substrate temperature (e.g., the Specification, Page 6, Lines 18-19; Page 6, Line 23 to Page 7, Line 2; Page 9, Lines 16-18; Page 11, Lines 10-12).

The invention of claim 19 includes the various limitations of claim 11, and adds that varying the dopant supply rate includes closed loop control of dopant source supply rate with active temperature feedback from a reaction chamber (e.g., FIG. 8, item **812**, and the Specification, Page 12, Lines 16-20).

6. Issues

The issues presented for review are set forth below.

Issue 1 - Whether claims 1-3, 5, 7 and 9-10 are patentable over *Lin et al.* (U.S. Patent No. 6,100,202) in view of *Chen et al.* (U.S. Patent No. 6,541,394).

Issue 2 - Whether claim 4 is patentable over *Lin et al.* in view of *Chen et al.* further in view of view of *Vassiliev et al.* (U.S. Patent No. 6,355,581).

Issue 3 - Whether claim 8 is patentable over *Lin et al.* in view of *Chen et al.* further in view of view of *Wang et al.* (U.S. Patent No. 4,376,672).

Issue 4 - Whether claims 11, 13-16 and 18-19 are patentable over *Lin et al.* in view of *Barnes et al.* (U.S. Patent No. 6,251,546), further in view of *Wang et al.*

7. Grouping of Claims

Claims 1-2, 4-5 and 6-10 stand or fall together.

Claim 3 stands or falls alone.

Claims 11-18 stand or fall together.

Claim 19 stands or falls alone.

8. Argument

8(i) Rejections Under 35 U.S.C. §112, First Paragraph

No claims were rejected on these grounds.

8(ii) Rejections Under 35 U.S.C. §112, Second Paragraph

No claims were rejected on these grounds.

8(iii) Rejections Under 35 U.S.C. §102

No claims were rejected on these grounds.

8(iv) Rejections Under 35 U.S.C. §103

The following arguments explain why the claim groups indicated in Section 7 are believed to be separately patentable.

A. Issue 1 - Whether claims 1-3, 5, 7 and 9-10 are patentable over *Lin et al.* (U.S. Patent No. 6,100,202) in view of *Chen et al.* (U.S. Patent No. 6,541,394).

The invention of claim 1 is directed to a method that includes varying a dopant supply rate for a doped insulating layer according to a variation in temperature of a substrate on which the doped insulating layer is formed. Varying the dopant supply rate includes increasing the dopant supply rate as the substrate temperature increases.

As is well known, to establish a prima facie case of obviousness, a rejection must meet three basic criteria. First, there must be some suggestion or motivation to modify a reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference(s) must teach or suggest all claim limitations.

1. The Combination of References Does Not Show of Suggest All the Limitations of Claim 1.

The cited references do not show or suggest the limitations of

a) varying a dopant supply rate for a doped insulating layer, wherein

a) varying the dopant supply rate includes increasing the dopant supply rate.

The secondary reference *Chen et al.* provides no teachings regarding doped insulating layers, thus this reference cannot show the above claim limitations directed to a doped insulating

layer.[1] Further, because *Chen et al.* teaches away from forming doped insulating layers, the reference cannot be suggestive of such a limitation.[2]

The remaining reference of the cited combination, *Lin et al.*, does not show or suggest the above limitations, either. Appellants' claim 1 recites the following:

"varying a dopant supply rate for a doped insulating layer".

Lin et al. shows no such limitation. In *Lin et al.* a doped insulating layer is formed, but the reference teaches the following:

a. forming an undoped insulating layer by not supplying a dopant, and then
b. providing an unvarying dopant supply rate to form a doped insulating layer.

These teachings will now be detailed at length to clearly show that the cited combination of reference does not show or suggest the limitations of claim 1.

The general method of *Lin et al.* describes a method that includes (1) a pre-deposition stabilization process step and (2) a doped silicate glass dielectric formation step. The pre-deposition stabilization is intentionally undoped and thus cannot show or suggest Appellants' claim 1 limitation of "varying a dopant supply rate to form a doped insulating layer".

> [A] pre-deposition stabilization process step where the substrate is stabilized with respect to a first flow of a silicon source material ***absent a dopant source material***.[3]

As emphasized above, Appellants' claim 1 limitations are directed to varying a dopant supply

[1] See *Chen et al.*, in its entirety beginning with the Summary of Invention Col. 3, Line 15. The entire reference is directed to the formation of an undoped oxide layer in its entirety beginning with the

[2] See Appellants' arguments set forth in Section 8(iv)A.2. related to motivation to combine the reference.

[3] *Lin et al.*, Col. 5, Lines 61-62, emphasis added.

rate for a doped insulating layer. Accordingly, this pre-deposition stabilization process cannot show or suggest such claim limitations as it intentionally forms an undoped insulating layer. That is, this step shows "forming an undoped insulating layer by not supplying a dopant" as noted above.

The general method of *Lin et al.* proceeds to describe the formation of a doped silicate glass. However, the dopant supply rate is never varied, let alone increased:

> Subsequent to the pre-deposition stabilization process step, the doped silicate glass dielectric layer is formed employing a second flow of the silicon source material, a flow of an oxidant source material and the flow of the dopant source material.[4]

Thus, with respect to a doped layer, the above excerpt only describes one unvarying flow rate for the dopant source material. Accordingly, this first example does not show any variation in dopant supply rate.

The next example of *Lin et al.* is no more suggestive of Appellants claim 1 limitations than the above first example.

The second example describes the formation of a doped pre-metal dielectric (PMD) layer 44 formed over an undoped PMD layer 40. However, in forming PMD layer 44, a dopant supply is never varied:

> ***[T]he flow*** of the dopant source material which preferably includes both a boron dopant source material and a phosphorus dopant source material. More preferably... the boron dopant source material is triethyl borane (B(C2H5)3) and the phosphorus dopant source material is triethyl phosphite (P(OC2H5)3)...[5]

Particular ranges are given for the flow of dopant source materials, but variation or an increasing supply rate are not shown or suggested by this example:

---

[4] *Lin et al.*, Col. 5, Lines 63-67.
[5] *Lin et al.*, Col. 9, Lines 32-37, emphasis added.

> [T]he triethyl borane boron dopant source material flow rate of from about 180 to about 200 standard cubic centimeters per minute (sccm); and (6) the triethyl phosphite phosphorus dopant source material flow rate of from about 30 to about 40... sccm...[6]

As in the case of the first example of *Lin et al.*, Appellants do not believe that the two deposition steps of forming the undoped PMD layer 40 and subsequently forming the doped PMD layer 44 can show or suggest the limitations of claim 1. That is, steps for forming the undoped PMD layer cannot be construed as showing a dopant supply rate of a doped insulating layer.

The last example of *Lin et al.* does not show or suggest the above noted limitations of Appellant's claim 1, as the reference explicitly teaches decreasing a dopant flow rate.

> The second deposition step employed materials and flows otherwise equivalent to those employed within the first deposition step, with the exception that the triethyl phosphite flow was ***reduced*** to about 34... sccm...[7]

Appellants' believe all of the above demonstrates that the reference *Lin et al.* does not show or suggest "increasing the dopant supply rate" as recited in claim 1.

Appellants acknowledge the rejection rationale set forth in the previous Office Actions for this case. However, the rejection rationale is believed to rely on an interpretation of the claims that is contrary to the explicit language of claim 1, and certainly contrary to the teachings of Appellants' Specification. The rejection rationale is quoted below:

> Applicant argued that Lin et al. never shows "increasing the dopant supply rate". However, Lin et al. teaches increasing the dopant supply rate because the dopant supply rate is increased from zero... to the flow of the dopant source material

[6] See *Lin et al.*, Col. 10, Lines 11-13.
[7] *Lin et al.*, Col. 15, Lines 22-26, emphasis added.

during the deposition of the doped silicate glass dielectric...[8]

The above argument overlooks Appellants' claim language. Appellants' claim 1 recites:

"varying a dopant supply rate for a doped insulating layer".

If one is forming an insulating layer with a dopant supply rate of zero, as argued by the rejection, one cannot be varying a dopant supply for a doped insulating layer, as one is forming an undoped insulating layer. That is, the rejection's rationale does not give the words of the claim their plain ordinary meaning, as it argues Appellants "doped insulating layer" corresponds to an undoped insulating layer.

Appellants' interpretation is also well supported by the Specification. All references to "varying a dopant supply rate" are clearly directed to changing from one non-zero value to another non-zero value.[9]

For all of the above reasons, Appellants believe that the cited combination of references does not show all limitations of a claim 1, a thus a prima facie case of obvious cannot have been established.

2. The Combination of References Does Not Provide Motivation for the Proposed Combination.

In addition or alternatively, Appellants believe that claim 1 is patentable over the cited references, as the requisite motivation necessary to combine *Lin et al.* in view of *Chen et al.*, is lacking. In particular, there is no motivation to combine *Chen et al.* with *Lin et al.*, as the references teaches away from such a combination.

As noted above, *Lin et al.* provides teachings regarding a pre-metal dielectric layer that may include a doped portion. In contrast *Chen et al.* is directed to growing a high quality undoped oxide layer. *Lin et al.* repeatedly emphasizes that dopants in its oxide film are undesirable as such dopants can outdiffuse into a transistor channel region:

[8] See the Final Office Action, dated 02/05/2004, Page 6, last full paragraph.
[9] See the Specification, Page 7, Lines 7-15, and FIG. 6.

> The introduction of nitrogen atoms into the gate dielectric may ***suppress diffusion of boron atoms*** from heavily doped p+ polycrystalline silicon gate electrodes...[10]

> Silicon dioxide is not a good ***diffusion barrier for gate electrode dopants***, such as boron.[11]

> The first oxide portion 31 may further comprise an uppermost nitride portion, for example, not shown. The nitride portion serves to ***block dopant penetration in to the oxide layer 30*** as will be readily understood by those skilled in the art. [12]

The above is believed to clearly show that *Chen et al.* directed to blocking dopants from entering a gate oxide layer, and thus teaches away from forming a doped oxide layer.

For these reasons, Appellants' do not believe there is sufficient motivation to combine the references for a prima facie case of obviousness.

Appellants acknowledge the reasoning for maintaining the rejection:

> In response to Applicant's arguments... Chen et al. is cited as evidence to show that increasing the temperature during the formation of the insulating layer is well known in the art... In addition, disclosed examples and preferred embodiments do not constitute teaching away from a broader disclosure or nonpreferred embodiments.[13]

Appellants' above showing does not refer only to specific examples or embodiments, and presents the broad teachings of the reference. Further, ignoring Appellants' showing regarding the full teachings of the reference is improper:

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[10] *Chen et al.*, Col. 1, Lines 50-53, emphasis added.
[11] *Chen et al.*, Col. 2, Lines 12-13, emphasis added.
[12] *Chen et al.*, Col. 2, Lines 50-53, emphasis added.
[13] The Final Office Action, dated 2/5/04, Page 7, Lines 1-6.

> [P]rior art references... must be read as a whole and consideration must be given where the references diverge and teach away from the claimed invention...[14]

The above excerpts from *Chen et al.* that teach away from doping an oxide are not mere examples or "non-preferred" embodiments. The excerpts are taken from the BACKGROUND OF THE INVENTION of *Chen et al.* to describe the problem the invention seeks to address. A full reading of this material shows that the broad teachings of the reference are that dopants are undesirable and need to be blocked by way of a barrier. Thus, the various embodiments are all directed to undoped oxide layers. Such teachings are contrary to the intentionally doped layer of *Lin et al.*

3. Appellants' Reply is Fully Responsive.

With regard to claim 1, the final rejection of the claim has raised the issue that Appellants' arguments do not fully address the rejection:

> In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking the references individually where the rejections are based on combinations of references.[15]

Appellants' believe the above and previous showings have not attacked individual references, but have attacked the prima face case presented by the rejections. Appellants will thus clarify how the above argument fully addresses the ground for rejection.

First, the rejection of claim 1 relies on *Lin et al.* to show the limitations of varying a dopant supply rate for a doped insulating layer:

> Lin et al. teaches varying a dopant supply rate for a doped insulating layer...[16]

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[14] Akzo N.V. v. United States Intl' Trade Comm'n, 1 USPQ 2d 1241, 1246 (Fed. Cir. 1986).
[15] See the Final Office Action, dated 02/05/2004, Page 7, Lines 7-10.
[16] Final Office Action, dated 02/05/2004, Page 2, third line of section 3.

Thus, it is the rejection that argues the above particular limitation is taught by *Lin et al.* Appellants' above argument in Section 8(iv)A.1. shows that such a limitation is not shown in the reference. Accordingly, Appellants are not arguing against a single reference, but pointing out how the references cannot present a prima facie case of obviousness.

Second, the rejection of claim 1 admits that the base reference *Lin et al.* provides no teachings regarding increasing a substrate temperature:

> Lin et al. does not specifically show increasing the substrate temperature.[17]

To show such a limitation, the rejection relies on the secondary reference *Chen et al.* Further, motivation for the proposed combination is taken from *Chen et al.*

> [I]t would have been obvious... to modify Lin et al. reference by increasing the temperature as taught by Chen et al. in order to reduce stress and to increase reliability (Chen et al., col. 3, lines 31-33)[18]

Thus, it is the rejection that argues motivation for the prima facie case is found in *Chen et al.* Appellants' argument in Section 8(iv)A.2. above is provided to show that the reference does not provide such motivation. Accordingly, in this case too, Appellants are not arguing against a single reference, but are pointing out perceived shortcomings in the prima facie case presented.

Because the cited combination of references does not show or suggest all the limitations of claim 1, and because sufficient suggestion or motivation for the proposed combination is not present in the references, a prima facie case of obviousness has not been established for the rejection of claim 1. Accordingly, Appellant respectfully seeks reversal of the rejection of claims 1-3, 5, 7 and 9-10.

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[17] Final Office Action, dated 02/05/2004, Page 3, Line 8.
[18] See the Final Office Action, dated 02/05/2004, Page 3, Lines 11-14.

4. Separate Patentability of Claim 3.

Dependent claim 3 includes additional limitations not shown or suggested by the cited combination of reference. Claim 3 recites that different dopant supply rates are provided for different time periods. Further, the different time periods include periods of the same length. As understood from the above arguments for claim 1, there is only one example in *Lin et al.* that shows different flow rates for a phosphorous dopant source. The example teaches first and second deposition steps. However, such deposition steps are for time periods of different lengths:

> The first deposition step employed... for a time period of about ***2 seconds***. The second deposition step employed... for a time period of about ***180 seconds***...[19]

Appellants' believe the above disparity in time period lengths (2 seconds versus 180 seconds) clearly teaches away from the "periods of same length" limitation set forth in claim 3.

No evidence or argument has ever been provided to rebut the above showing.[20]

Accordingly, Appellant respectfully seeks reversal of the rejection of claim 3 on these additional grounds.

B. Issue 2 - Whether claim 4 is patentable over *Lin et al.* in view of *Chen et al.* further in view of view of *Vassiliev et al.* (U.S. Patent No. 6,355,581).

To the extent that this ground of rejection relies on the combination of *Lin et al.* in view of *Chen et al.*, Appellants incorporate by reference herein the comments set forth above for **Issue 1**. Namely, the combination does not show or suggest all limitations of claim 1 and/or motivation for combining *Lin et al.* in view of *Chen et al.* is believed to be lacking

[19] *Lin et al.*, Col. 15, Lines 12-28, emphasis added.
[20] Appellants' argument and evidence was originally presented in the Response to Office Action, dated 11/14/2003. It remained unrebutted in subsequent Final Office Action, dated 02/05/04, and Advisory Action, dated 04/13/04.

C. Issue 3 - Whether claim 8 is patentable over *Lin et al.* in view of *Chen et al.* further in view of view of *Wang et al.* (U.S. Patent No. 4,376,672).

To the extent that this ground of rejection relies on the combination of *Lin et al.* in view of *Chen et al.*, Appellants incorporate by reference herein the comments set forth above for **Issue 1**. Namely, the combination does not show or suggest all limitations of claim 1 and/or motivation for combining *Lin et al.* in view of *Chen et al.* is believed to be lacking.

D. Issue 4 - Whether claims 11, 13-16 and 18-19 are patentable over *Lin et al.* in view of *Barnes et al.* (U.S. Patent No. 6,251,546), further in view of *Wang et al.*

The invention of amended claim 11 is directed to a method that includes compensating for a temperature dependent gradient in a doped insulating film. The doped insulating film comprises silicon oxide with a phosphorous concentration greater than about 7% by weight. Such a compensating step includes varying a dopant supply rate as the doped insulating film is formed. Further, the dopant supply rate is varied for an initial thickness of the doped insulating film to compensate for variations in a substrate temperature.

1. The Combination of References Does Not Show All the Limitations of Claim 11.

As emphasized above, Appellants' claim 11 invention includes compensating for a temperature dependent gradient in a doped insulating film comprising silicon dioxide. Such a limitation is not shown or suggested by the cited combination of references.

It is admitted that *Lin et al.* does not show compensating for a temperature dependent gradient.[21] However, such a limitation is not shown in the remaining references, either.

While Appellants believe that the plain and ordinary meaning of the term "compensate" is understood, one definition is set forth below to emphasize the difference between the plain and ordinary meaning of the claim language as compared to the teachings of the cited references.

Main Entry: **com pen sate**

[21] See the Final Office Action, dated 02/05/2004, Page 5, Lines 10-15.

> **1 :** to be equivalent to **:** **COUNTERBALANCE**
>
> **2 :** to make an appropriate and usually counterbalancing payment to
>
> **3 a :** to provide with means of counteracting variation **b :** to neutralize the effect of (variations)[22]

This understanding of the word "Compensation" is also well supported in Appellants' Specification.

> The embodiments set forth approaches to forming an insulating material having essentially uniform doping on a substrate, while the temperature of the substrate varies. In one particular embodiment, flow rates of source gases can be varied to ***compensate*** for the effect of substrate temperature on dopant concentration.[23]
>
> According to the present invention, as a substrate temperature varies, a dopant supply rate can vary in a ***compensating*** fashion (e.g., increase, decrease or some variation thereof). As but one example, if an increase in temperature can result in lower concentration levels, a dopant source material supply rate can increase in time period Td.[24]
>
> To ***compensate*** for such variation, a temperature varying period may be divided into time periods (in the example, four periods of two seconds each). In each time period, a ratio may be adjusted to compensate for temperature effects on doping concentration.[25]

The prima facie case presented by the rejection appears to argue that Appellants compensation limitation of claim 11 is shown or suggested by *Barnes et al.*:

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[22] Merriam-Webster On-Line Dictionary, Internet: http://www.m-w.com.
[23] Appellants' Specification, Page 6, Lines 13-16.
[24] Appellants' Specification, Page 6, Line 22 to Page 7, Line 1-2.
[25] Appellants' Specification, Page 9, Lines 16-18.

> Lin et al. does not specifically show compensating for a temperature dopant gradient... However, Barnes et al. teaches that the dopant concentration is dependent from the reaction temperature (col. 6, lines 40-55, col. 7, lines 14-18). Barnes et al. shows using a feed back-based temperature control system and process gas control system that adjust the flow rates of the gas as necessary (col. 3, lines 15-23, 55-67).[26]

First, Appellants believe the above rationale is factually incorrect. *Barnes et al.* does not show the use of temperature feedback to control a dopant flow rate, as argued above, but rather the use of temperature feedback to control the temperature of a wafer.

> The measured temperature is used in a ***feedback loop*** to control the power supply 16 for the heating element 170, such that the ***wafer temperature can be maintained*** or controlled at a desired temperature which is suitable for the particular process application.[27]

> By properly adjusting the current supplied to the heating element 170, ***the wafer 190 and the pedestal 150 can be maintained at a relatively constant temperature*** during film deposition. This is accomplished by a ***feedback control loop***, in which the temperature of the pedestal 150 is continuously monitored by a thermocouple 172 embedded in the pedestal 150.[28]

Barnes et al. does teach a control unit responsible for automated control of various processing steps, including gas flow control and temperature control:

> This control unit 110 is responsible for automated control of the numerous steps required for wafer processing--such as wafer transport, gas flow control,

[26] See the Final Office Action, dated 02/05/04, Page 5, Lines 10-15.
[27] See *Barnes et al.*, Col. 3, Lines 19-25.
[28] See *Barnes et al.*, Col. 4, Lines 12-17.

temperature control, chamber evacuation, and other steps.[29]

However, *Barnes et al.* never shows or suggests that such a control unit is capable of varying gas flow according to temperature.

2. There is No Motivation for the Proposed Modification.

Further, even if the system of *Barnes et al.* was capable of varying gas flow according to temperature, the above teachings are not sufficient to render Appellants' claims obvious.

> *The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.*[30]

Barnes et al. not only does not suggest the desirability of the proposed modification, it teaches away from it.

Barnes et al. teaches relationships between temperature and insulating layer properties. More particularly, the reference teaches that as deposition temperature increases, a resulting dielectric constant decreases. In addition, as an impurity level (fluorine and/or carbon concentration) increases, a dielectric constant of the insulating layer decreases.[31]

Importantly, the reference never shows or suggests a compensating action in response to such relationships. In fact, *Barnes et al.* seems to indicate the opposite: maintaining a single temperature to arrive at one desired dielectric constant:

> The dielectric constant of the fluoro-organosilicate layer is tunable, in that it can be varied in a range between about 2.5 to about 3.5 as a function of ***the*** **reaction temperature**.[32]

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[29] See *Barnes et al.*, Col. 3, Line 67 to Col. 4, Line 3.
[30] In re Mills, 16 USPQ2d 1430 (Fed. Cir. 1990)
[31] See *Barnes et al.*, Col. 3, Lines 59-65, which describe mass flow controllers.
[32] *Barnes et al.*, Col. 6, Lines 39-42, emphasis added.

That is, Appellants' invention of claim 11 describes varying dopant rate as temperature changes. In sharp contrast, *Barnes et al.* teaches on keeping the substrate temperature unchanged in order to ensure that a resulting dielectric constant does not vary. This is repeatedly emphasized by the above excerpts from *Barnes et al.*, which stress maintaining a particular wafer temperature.

For all of these reasons, Appellants' believe a prima facie case of obviousness has not been established for claim 11, and this ground for rejection is traversed.

3. Separate Patentability of Claim 19.

Claim 19, which depends from claim 11, is believed to include additional features that are patentable over the cited references. Claim 19 recites that varying a dopant supply rate includes closed loop control of dopant source supply rate with active temperature feedback from a reaction chamber. Such a limitation is not shown in the cited references.

Neither *Lin et al.* nor *Wang et al.* provides teachings regarding temperature control of a chamber, and thus cannot show or suggest the limitations of claim 19.

As noted above, *Barnes et al.* describes forming a fluoro-organosilicate layer in a temperature control chamber. However, the reference never describes controlling a dopant source supply rate with active temperature feedback. The various teachings of the reference will now be discussed in detail to demonstrate this point.

Barnes et al. includes a temperature sensor and feedback loop. However, such features are utilized to maintain a constant temperature and are never utilized to vary the supply rate of any material, let alone a dopant source:

> [T]emperature sensor 172... is also embedded... to monitor the temperature of the pedestal 150 in a conventional manner. The measured temperature is used in a feedback loop to control the power supply 16 for the heating element 170, such that *the wafer temperature can be maintained or controlled at a desired temperature* which is suitable for the particular process application...[33]

[33] *Barnes et al.*, Col. 3, Lines 16-23, emphasis added.

> By properly adjusting the current supplied to the heating element 170, the wafer 190 and the pedestal 150 can be *maintained at a relatively constant temperature* during film deposition. This is accomplished by a feedback control loop, in which the temperature of the pedestal 150 is continuously monitored by a thermocouple 172... This information is transmitted to the control unit 110... which responds by sending the necessary signals to the heater power supply.[34]

From the above it is clear that this portion of the reference teaches feedback to maintain (i.e., not vary) a temperature. Further, the feedback remains unrelated to dopant supply rate and is directed solely to wafer temperature control.

The above is believed to clearly show that *Barnes et al.* uses temperature feedback to maintain a temperature, and not to vary a dopant supply rate. Thus, the combination of reference is not believed to show or suggest all limitations of claim 19. Accordingly, it is respectfully requested that the rejection of this claim be reversed for this additional reason.

Conclusion.

For the various reasons set forth above, Appellant respectfully contends that a prima facie case of obviousness was never established for the claims at issue. Accordingly, a reversal of all claim rejections is respectfully requested.

Respectfully Submitted,
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[34] *Barnes et al.*, Col. 4, Lines 12-21, emphasis added.

APPENDIX A

CLAIMS INVOLVED IN THE APPEAL

5

1. A method, comprising:

varying a dopant supply rate for a doped insulating layer according to a variation in temperature of a substrate on which the doped insulating layer is being formed; and

varying the dopant supply rate includes increasing the dopant supply rate as the substrate temperature increases.

2. The method of claim 1, wherein:

varying the dopant supply rate includes providing different dopant supply rates for different time periods.

3. The method of claim 2, wherein:

the different time periods include a plurality of time periods of the same length, the dopant supply rate being different during at least two of the time periods.

4. The method of claim 1, wherein:

the doped insulating layer is formed with a high density plasma deposition process.

5. The method of claim 1, wherein:

the doped insulating layer comprises phosphosilicate glass.

6. (Cancelled)

7. The method of claim 1, further including:

etching a contact hole through the doped insulating layer to the substrate.

8. The method of claim 7, wherein:

the doped insulating layer comprises phosphosilicate glass having a phosphorous dopant concentration of greater than about 6% by weight.

9. The method of claim 1, further including:

varying the dopant supply rate over a first period of time and maintaining a constant dopant supply rate for a second period of time.

10. The method of claim 9, wherein:

the first period of time precedes the second period of time.

11. A method, comprising:

compensating for a temperature dependent dopant gradient in a doped insulating film comprising silicon oxide having a phosphorous concentration greater than about 7% by weight, by varying a dopant supply rate as the doped insulating film is formed; wherein

the dopant supply rate is varied for an initial thickness of the doped insulating film to compensate for variations in a substrate temperature.

12. (Cancelled)

13. (Cancelled)

14. The method of claim 11, wherein:

the initial thickness is no more than 0.8 microns.

15. The method of claim 11, wherein:

the initial thickness is no more than 0.4 microns.

16. The method of claim 11, wherein:

varying the dopant supply rate includes altering a supply rate ratio given by a dopant source supply rate divided by the dopant source supply rate plus a base material source supply rate.

17. The method of claim 16, wherein:

the dopant source supply rate includes a flow rate for a source of phosphorous, the base material source supply rate includes a flow rate for a source of silicon, and the supply rate ratio varies from about 30% to 45%.

18. The method of claim 11, further including:

varying the dopant supply rate for a first portion of the insulating film and maintaining a constant dopant supply rate for a second portion of the insulating film.

19. The method of claim 11, further including:

varying the dopant supply rate includes closed loop control of dopant source supply rate with active temperature feedback from a reaction chamber.

20. (Withdrawn)

21. (Withdrawn)

22. (Withdrawn)